REMARKS

Applicants have carefully considered the points raised in the Office Action and believe that the Examiner's concerns have been addressed as described herein, thereby placing this case into condition for allowance.

Status of the claims

Claims 1-3, 6-11, 14-27, 29-35, 38-40, and 49-58 were pending in this application. By virtue of this amendment claims 1-3, 6-11, 14-27, 30-35, 38-40, and 49-58 have been amended, and claim 29 has been canceled. Claims 1-3, 6-11, 14-27, 30-35, 38-40, and 49-58 are currently under consideration.

The claims have been amended to improve clarity and for consistency of claim terms within the claim set. Support for the amendment to claim 17 may be found, for example, on page 4, lines 2-3, of the specification. No new matter is added by these amendments.

With respect to any claim amendments or cancellations, Applicants have not dedicated to the public or abandoned any unclaimed subject matter and moreover have not acquiesced to any rejections and/or objections made by the Patent Office. Applicants expressly reserve the right to pursue prosecution of any presently excluded subject matter or claim embodiments in one or more future continuation and/or divisional application(s).

Claim Objections

Claims 27, 33, 35, 50, and 51 are objected to for various informalities. Claims 27, 33, and 35, as amended in this response, no longer include the claim language that is objected to. Claims 50 and 51 have been amended to incorporate the Examiner's preferred language. Thus, the objections to the claims are moot.

Withdrawal of the objections is respectfully requested.

Rejections under 35 U.S.C. §112, first paragraph

Claims 1, 25, and 33

Claims 1, 25, and 33 are rejected under 35 U.S.C. §112, first paragraph, as allegedly not supported by adequate written description. The Examiner states that it is unclear where the newly added limitations that the prelift zone is "adapted to lift catalytic cracking catalyst to a first reaction zone *without cracking hydrocarbons* in that prelift zone" in claim 1, or that the prelift zone is used "to transport the catalytic cracking catalyst to the first reaction zone *without reacting hydrocarbon* in the prelift zone" in claims 25 and 33, are supported by the disclosure. Applicants respectfully traverse this rejection.

In response, Applicants respectfully note that the prelift zone contains only a prelifting medium and a catalyst and is *free of hydrocarbons*. Therefore, only the catalyst is lifted and *no cracking of hydrocarbons occurs* in the prelift zone. It would be readily apparent to a person of ordinary skill in the art that no hydrocarbon cracking reaction can occur when no hydrocarbons are present. Support for this concept is also provided in the disclosure, which states that "[t]he function of the [prelift] zone is to lift regenerated catalyst upward and to improve initial feed and catalyst contacting with the aid of a prelift medium." Page 3, lines 24-26. In contrast to the prelift zone, the specification describes the process taking place in the first reaction zone as including contacting of feedstock with hot catalyst "with the result that the *primary* cracking reaction takes place." Page 5, lines 10-12, emphasis added. Thus, the first (primary) cracking reaction that takes place in the reactor is in the first reaction zone, not in the prelift zone. This is also exemplified in Figure 1, as described on page 9 of the specification: "A prelift medium is introduced into the prelift zone 2 via conduit 1. Hot regenerated catalyst flows into the prelift zone 2 via regenerated catalyst standpipe 3 and is lifted by prelift medium. The preheated feedstock mixed with dispersion steam is charged into the prelift zone via conduit 4, and then is contacted with hot regenerated catalyst, *flowing into the first reaction zone 5 where cracking reaction takes place* under certain reaction conditions." Page 9, lines 7-12, emphasis added. The specification describes a cracking reaction as taking place in the first reaction zone, and describes the prelift zone as an area where regenerated catalyst is

lifted by prelift medium. The specification does not describe the prelift zone as an area where cracking reactions occur.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, first paragraph.

Claim 57

Claim 57 is rejected under 35 U.S.C. §112, first paragraph, as allegedly not supported by adequate written description. The Examiner states that it is unclear where the newly added limitation of "a heat exchanger between the first reaction zone and the second reaction zone adapted to cool at least a portion of hydrocarbon and a catalyst passing between the first reaction zone and the second reaction zone" in claim 57 is supported by the disclosure. The Examiner states that the specification at page 5, lines 13-27, discloses that a heat exchanger or heat remover may be provided in the second reaction zone, but does not disclose a heat exchanger located between the first and second reaction zones. Applicants respectfully traverse this rejection.

The specification states that when the temperature of the second reaction zone must be maintained at a lower temperature, "a quenching medium can be introduced into the conjunct section between this zone and the first reaction zone and/or the heat remover is installed to remove part of [the] heat of the zone so as to lower the reaction temperature of this zone." Page 5, lines 15-20. The specification states that a heat remover may be installed to lower the reaction temperature in the second reaction zone, but does not specify that the heat remover, if present, must be located in the second reaction zone. However, solely to expedite prosecution and without acquiescence to the rejection, claim 57 has been amended to recite that the heat exchanger is located in the second reaction zone, rendering the rejection moot.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, first paragraph.

Rejections under 35 U.S.C. §112, second paragraph

Claim 1

Claim 1 is rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite.

The Examiner states that the relationship between the "catalytic cracking catalyst" in line 9 and the "catalytic cracking catalyst" in lines 5-7 is unclear, and that the relationship between the "catalytic cracking catalyst" in line 16 and the "catalytic cracking catalyst" in lines 5-7 or lines 8-13 is also unclear. The catalytic cracking catalyst recited in various places in the claim refers to the same catalyst. For improved clarity, claim 1 has been amended to recite "said catalytic cracking catalyst" in subsequent recitations after the first recitation of the term.

The Examiner states that "the next reaction zone having an iso-diameter" lacks proper positive antecedent basis and is unclear. By virtue of this amendment, this phrase has been deleted from the claim, rendering this part of the rejection moot.

The Examiner also rejects the claim on the basis that the claim contains language that recited structural elements are adapted to perform particular functions. The Examiner states that recitation that an element is "adapted to" perform a function is not a positive limitation but only requires the ability to so perform and does not constitute a limitation in any patentable sense. In support of this statement, the Examiner cites *In re Hutchinson*, 69 USPQ 138. In response, Applicants respectfully note that *In re Hutchinson* involves a novelty rejection, and thus is inapplicable to the present indefiniteness rejection. The court in *In re Hutchinson* did not state that recitation that an element was "adapted" for use made the claim unclear. Further, "adapted" was recited in the preamble in the claims discussed in *In re Hutchinson*, whereas in the present claim this term is recited in the body of the claim in the context of describing structural elements of the riser reactor. Thus, both the facts and application of the law in *In re Hutchinson* do not apply to the present rejection.

Applicants refer the Examiner to MPEP §2173.05(g), which states that "[t]here is nothing inherently wrong with defining some part of an invention in functional terms. Functional language does not, in and of itself, render a claim improper. . . .A functional limitation must be evaluated and

considered, just like any other limitation of the claim, for what it fairly conveys to a person of ordinary skill in the pertinent art in the context in which it is used." Applicants also draw the Examiner's attention to the decision in *In re Venezia*, 189 USPQ 149, in which the court held that a claim that recited that components of a kit were "adapted to" be affixed or positioned "define the metes and bounds of the claimed invention with a reasonable degree of precision and particularity and that they are, therefore, definite as required by the second paragraph of section 112." The court stated, "We see nothing wrong in defining the structures of the components of the completed connector assembly in terms of the interrelationship of the components, or the attributes they must possess, in the completed assembly. More particularly, we find nothing indefinite in these claims." Similarly, claim 1 of the instant application recites structural elements that are adapted to perform a particular function. This language does not render the claim indefinite because the structural elements are defined in terms of attributes that they must possess to be encompassed within the scope of the claims, as in *In re Venezia*, discussed above. Applicants submit that claim 1 is clear as written with respect to the "adapted to" language.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Claim 6

Claim 6 is rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite. The Examiner states that the recitation in the claim of "comprising said outlet zone . . . and the height of said optional outlet zone is from 0% to about 20% of the height of the riser reactor" is contradictory with respect to the structural limitation because it is unclear whether the outlet zone is included in the reactor.

Solely to clarify the claim, claim 6 has been amended to recite that the claimed reactor comprises "said optional outlet zone," antecedent basis for which is provided in claim 1, from which claim 6 depends. It is clear from claim 1 that the outlet zone is an optional feature of the reactor. Claim 6 is directed to and further defines an embodiment of a reactor comprising this optional feature. The claim language "from about 0% to about 20% of the height of the riser reactor" has

been amended to recite "up to about 20%," to clarify that the outlet zone is present in this claimed embodiment and cannot therefore comprise 0% of the height of the reactor.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Claim 14

Claim 14 is rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite. The Examiner states that the relationship of "an outlet zone" in claim 14, line 1, and "an outlet zone" in claim 9, line 22, is unclear and that the recitation in the claim of "comprising said outlet zone . . . and the height of said optional outlet zone is from 0% to about 20% of the height of the riser reactor" is contradictory with respect to the structural limitation because it is unclear whether the outlet zone is included in the reactor.

Solely to clarify the claim, claim 14 has been amended to recite that the claimed reactor comprises "said optional outlet zone," antecedent basis for which is provided in claim 9 as amended, and from which claim 14 depends. It is clear from claim 9 as amended that the outlet zone is an optional feature of the reactor. Claim 14 is directed to and further defines an embodiment of a reactor comprising this optional feature. The claim language "from about 0% to about 20% of the height of the riser reactor" has been amended to recite "up to about 20%," to clarify that the outlet zone is present in this claimed embodiment and cannot therefore comprise 0% of the height of the reactor.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Claim 16

Claim 16 is rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite. The Examiner states the relationship of "an outlet zone" in line 1 and "an outlet zone" in claim 9, line 22, is unclear.

Solely to clarify the claim, claim 16 has been amended to recite that the claimed reactor comprises "said optional outlet zone," antecedent basis for which is provided in claim 9 as amended, and from which claim 16 depends. It is clear from claim 9 as amended that the outlet zone is an optional feature of the reactor. Claim 16 is directed to and further defines an embodiment of a reactor comprising this optional feature.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Claims 26, 27, and 29-32

Claims 26, 27, and 29-32 are rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite. The Examiner states that the recitation of "providing the reactor system" lacks proper antecedent basis, since the step of "providing the *riser reactor*" is set forth in claim 25, from which the rejected claims depend, and further, that the structural relationship of a "reactor system" to the other elements of the apparatus is unclear. The language referred to by the Examiner in the rejection has been deleted from the claims, rendering the rejection moot.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Claim 29

Claim 29 is rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite. By virtue of this amendment, claim 29 has been canceled, rendering the rejection moot.

Claim 30

Claim 30 is rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite. The Examiner states that the recitation in the claim of "comprising said outlet zone . . . and the height of said optional outlet zone is from 0% to about 20% of the height of the riser reactor" is contradictory

with respect to the structural limitation because it is unclear whether the outlet zone is included in the reactor.

Solely to clarify the claim, claim 30 has been amended to recite that the claimed reactor comprises "said optional outlet zone," antecedent basis for which is provided in claim 25 as amended, and from which claim 30 depends. It is clear from claim 25 as amended that the outlet zone is an optional feature of the reactor. Claim 30 is directed to and further defines an embodiment of a reactor comprising this optional feature. The claim language "from about 0% to about 20% of the height of the riser reactor" has been amended to recite "up to about 20%," to clarify that the outlet zone is present in this claimed embodiment and cannot therefore comprise 0% of the height of the reactor.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Claim 33

Claim 33 is rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite, due to recitation of "and wherein the step of passing the first reaction zone stream from the first reaction zone to the second reaction zone and wherein the step of wherein" in lines 29-30, and because the "the optional outlet zone" in lines 38-39 lacks antecedent basis in claim 9, from which claim 33 depends.

Claim 33 has been amended to delete the language "and wherein the step of passing the first reaction zone stream from the first reaction zone to the second reaction zone and wherein the step of wherein," rendering this part of the rejection moot. With respect to the "optional outlet zone," antecedent basis for this term is provided in claim 9 as amended.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Claims 34, 35, and 38-40

Claims 34, 35, and 38-40 are rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite. The Examiner states that the recitation of "providing the reactor system" lacks proper antecedent basis, since the step of "providing the *riser reactor*" is set forth in claim 33, from which the rejected claims depend, and further, that the structural relationship of a "reactor system" to the other elements of the apparatus is unclear. The language referred to by the Examiner in the rejection has been deleted from the claims, rendering the rejection moot.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Claim 55

Claim 55 is rejected under 35 U.S.C. §112, second paragraph, as allegedly indefinite. The Examiner states that the relationship between "an outlet zone" in claim 55, line 1, and "an optional outlet zone" in claim 1, line 21, is unclear.

Claim 55 as amended recites "said optional outlet zone," antecedent basis for which is provided in claim 1, from which claim 55 depends.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

Rejection under 35 U.S.C. §102(b)

Claims 17 and 18 are rejected under 35 U.S.C. §102(b) as allegedly anticipated by Skraba et al. (U.S. Patent No. 4,681,743). Applicants respectfully traverse this rejection.

The structure of the reactor disclosed by Skraba et al. is different than that of the riser reactors according to claims 17 and 18. The reactor disclosed in Skraba et al. comprises lift pot 37, a first generally cylindrical portion 82, and a second generally cylindrical portion 84 (see figures 1 and 2, and col. 4, line 58 – col. 5, line 21 of Skraba et al.). The lift pot 37 of Skraba et al. is

different from the prelift zone in the present invention in two aspects. Firstly, the diameter of the lift pot 37 is larger than that of the first generally cylindrical portion 82 (see figure 2 of Skraba et al.), whereas in the presently claimed invention, the diameter of the prelift zone is less than or equal to that of the first reaction zone (see, for example, page 4, lines 2-3 of the present application). By virtue of the amendment, claim 17 has been amended to recite that the diameter of the first reaction zone is greater than or equal to the diameter of the prelift zone. Secondly, an oil-gas reaction occurs in lift pot 37 of Skraba et al., because the starting material, oil, enters the lift pot via line 44. In contrast, in the present invention, the prelift zone only plays the role of lifting the catalyst (see, for example, page 3, line 24-27, of the present application). Although the ratio of the second generally cylindrical portion 84 diameter to the first generally cylindrical portion 82 diameter is 1.1 to 2.0 in Skraba et al. (col. 5, lines 18-21), the length of the first generally cylindrical portion 82 is only 4 feet in length and only accounts for 2.7% of the total length of the riser, which is 147 feet in length (see the sum of the lengths of the lift pot 37, first generally cylindrical portion 82, cone 86, and second generally cylindrical portion 84 in the table in column 8). In contrast, the height of the first reaction zone in the present invention is about 10-30% of the height of the riser reactor (see, for example, page 4, lines 4-5, of the present specification). Since the first generally cylindrical portion 82 of Skraba et al. is relatively short, and the ratio of the second generally cylindrical portion 84 diameter to the first generally cylindrical portion 82 diameter is less than 2.0, the first generally cylindrical portion 82 cannot play the role of the first reaction zone in the instant claims. It is would be apparent to a person of skill in the art that the role of the first generally cylindrical portion 82 of Skraba et al. is only to increase the linear velocity of oil gas so as to prevent back mixing at the initial phase of the reaction cause the oil-gas volume is relatively small (see col. 5, lines 5-6 of Skraba et al.). In contrast, claim 17 recites that a hydrocarbon cracking reaction takes place in the first reaction zone. Therefore, claims 17 and 18 are not anticipated by the reactor taught by Skraba et al.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §102(b).

Rejections under 35 U.S.C. §103(a)

Claims 1-3, 6, 7, 9011, 14, 15, 17-23, 25-27, 29-31, 33-35, 38, 39, 49-51, and 54-57 are rejected as allegedly unpatentable under 35 U.S.C. §103(a) over Kmecak et al. (EP 0 171 460) in view of Williams (US 4,422,925). Applicants respectfully traverse this rejection.

Neither Kmecak et al. nor Williams et al., nor the combination of these two references, teaches a riser reactor as claimed with the ratio of the second reaction zone diameter to the first reaction zone diameter in the range of about 1.5:1 to about 5:1.

The reactor disclosed by Kmecak et al. is a conventional FCC riser reactor with the diameter of the upper portion of the riser slightly increased. Since the length of the riser is 49 m (p. 49, lines 7-23), according to the Examiner's estimate, the height of the first reaction zone is 30% of the height of the riser, *i.e.* 14.7 m, the height of the second reaction zone is 50% of the height of the riser, *i.e.* 24.5 m, and the linear velocity of the riser ranges from 18 m/s to 31 m/s (see p. 49, lines 10-15). When the starting material oil is fed via feed inlet means 5 (see figure 8), the linear velocity at the outlet end of the so-called "first reaction zone" (the charge oil inlet conduit 5 and the frusto-conical transition section to portion 2) will not exceed the maximum linear velocity of 31 m/s. Even if the linear velocity at the outlet of the so-called first reaction zone is 31 m/s, the linear velocity of the second reaction zone is 13.8 m/s when the ratio of the second reaction zone diameter to the first reaction zone diameter is 1.5, *i.e.*, the oil gas contacts the catalyst for 1.78 seconds. It would be apparent to a person of skill in the art that the maximum linear velocity of the prelift section (the restricted diameter portion of the riser 1) is about 5 m/s, *i.e.*, the linear velocity at the inlet of the first reaction zone is 5 m/s, the linear velocity at the outlet of the first reaction zone is 31 m/s, and the average linear velocity of the first reaction zone is 14.4 m/s, so that the oil gas contacts the catalyst for 1.02 seconds in the first reaction zone, and the oil gas contacts the catalyst for 2.8 seconds altogether in the first and second reaction zones. These values were calculated with the proviso that the linear velocity at the outlet of the first reaction zone is 31 m/s. If the linear velocity at the outlet of the first reaction zone is less than 31 m/s, the oil gas will contact the catalyst for a total of more than 3.0 seconds in the first and second reaction zones. The reactor taught by Kmecak et al., however, requires that the oil gas contacts the catalyst for 3 seconds or less in the reactor (see

page 51, line 24 – page 52, line 5; page 40, lines 19-21; page 41, lines 7-12; page 49, lines 7-24). If the ratio of the second reaction zone diameter to the first reaction zone diameter exceeds 1.5, the linear velocity of the second reaction zone will be lower, so that the oil gas has to contact the catalyst for a longer period of time. Thus, it is not possible for the ratio of the second reaction zone diameter to the first reaction zone diameter to exceed 1.5:1, let alone 3:1 as estimated by the Examiner, in the reactor taught in the cited reference.

In an Advisory Action dated August 3, 2005, the Examiner stated, with respect to the above arguments, that "it is unclear as to how applicant has arrived at the stated values because the calculations used to obtain the stated values has not been provided" and that "the velocity stated by Kmecak et al. is the linear velocity through *the entire riser reactor*, and not a maximum linear velocity achieved within a particular zone of the riser reactor, as argued by applicants." In response, Applicants respectfully note that in the case in which the linear velocity at the outlet of the so-called "first reaction zone" (*i.e.*, the charge oil inlet conduit 5 and the frusto-conical transition section to portion 2) is greater than a maximum linear velocity of 31 m/s, with the average linear velocity through the entire riser reactor of 31 m/s, with the ratio of the "second reaction zone" diameter to the "first reaction zone" diameter of 1.5, the linear velocity at the outlet of the so-called "first reaction zone" will be 42.9 m/s. This velocity is calculated using the formula [Us + Us/2.25]/2 = 31 m/s, where Us represents the linear velocity at the outlet of the so-called "first reaction zone."

When the linear velocity at the outlet of the so-called "first reaction zone" is 42.9 m/s, the linear velocity at the inlet of the so-called "first reaction zone" is 36 m/s (logarithmic mean value), which is greater than 30 m/s. This formula used for making this calculation is [42.9-30]/ln[42.9/30]. If the height of the first reaction zone is 30% of the height of the riser, *i.e.*, 14.7 m, the oil vapor contacts the catalyst for only 0.4 second. It is well known in the art that it is difficult to satisfy cracking reaction conditions required for a normal FCC process in such a short period of time, and it is difficult for the zone described in this reference to satisfy the role of the first reaction zone as disclosed in the present application. In the examples of the present application, the reaction time in the first reaction zone ranges from 0.8 to 1.5 seconds.

Further, when the average linear velocity of the so-called "first reaction zone" of Kmecak et al. is greater than 30 m/s, judging from the flow pattern of fluidization, the gas in the entire riser is transported in dilute phase, and the oil vapor cannot fully contact the catalyst. A person of ordinary skill in this art would understand that when the average linear velocity of the riser is about 30 m/s or greater, the reactor no longer acts as a riser reactor, but rather acts as a duct. This is illustrated in Figure 7.19 of Fluidization, J.F. Davidson et al., ed., Academic Press, Orlando, Florida, 1985, page 257, a copy of which is attached as Exhibit A. This figure shows that when the linear velocity of the gas is greater than 10 m/s, the voidage of the riser is nearly 1, which means that the content of catalyst in the riser is relatively low. This point is further illustrated in Fig. 10-10 of Fluidization Idealized and Bubbleless with Applications, M. Kwauk, ed., Science Press, Beijing, 1992, page 175, a copy of which is attached as Exhibit B. A person of ordinary skill in the art would realize that if the linear velocity at the outlet of a riser ranges from about 20 m/s to not more than 30 m/s, the average linear velocity of the entire riser ranges from about 10 to 15 m/s, which is between that of a high-velocity fluidized bed and that of a gas dilute phase transport system.

Therefore, it is impossible for the so-called "first reaction zone" taught by Kmecak et al. to have a linear velocity at its outlet greater than 31 m/s, because it would not act as a riser reactor. If the average linear velocity of the reactor is lower than 31 m/s and the reaction time exceeds 3 seconds, *i.e.*, if the ratio of the second reaction zone diameter to the first reaction zone diameter exceeds 1.5, the design requirements of Kmecak et al. will not be satisfied. In contrast, in the riser reactor taught in the present application, the oil vapor generally contacts the catalyst for more than 4.0 seconds.

As discussed above, Kmecak et al. does not teach a riser with the claimed ratios of reaction zone diameters. In the Office Action, the Examiner also states that "Kmecak et al. . . .is silent as to the ratio of the second reaction zone **2** diameter to the first reaction zone **1** diameter being, specifically in the range of from about 1.5:1 to about 5:1." Office Action, page 9.

The teachings of Williams et al. do not cure this defect of Kmecak et al. with respect to teaching the elements of the presently claimed invention. The reactor disclosed in Williams et al. is designed to crack different types of hydrocarbons. It is well known in the art that difficulty in

cracking different types of hydrocarbons varies as follows from most difficult to easiest: propane > naphtha feed > raffinate naphtha > fractionate bottom recycle. Therefore, different reaction conditions are required for cracking different types of hydrocarbons. The reactor taught by Williams et al. is designed for reaction of different hydrocarbons in different zones of the reactor. Zone 9 in the reactor of Williams et al. is not a prelift zone, as in the present invention, but is a section for cracking propane, and in this section, propane is cracked into propylene. Reactor section 10 of Williams et al. is not the first reaction zone as in the presently claimed invention, but is a section for cracking naphtha into light olefins. Reaction section 11 is not the second reaction zone as in the present claims, but is a section for cracking raffinate naphtha, and so on. Although each of sections 9, 10, and 11 has a larger cross-sectional area than the preceding section, the ratio of the diameter of the parts connecting the sections should be less than 1.5, according to conventional calculations. Otherwise, if the diameter of the upper section is too large and the linear velocity of the gas is too low, the extent of back mixing will be increased along with an increase in the yield of by-products, and there will be difficulty in carrying out fluidization transfer. In addiction, it is necessary to increase the diameter of the above reaction sections in order to prevent a rapid increase of the linear velocity of the gas because the linear velocity of the gas will increase correspondingly if the volume of the reactants expands and other reactants are added.

The reactor taught by Williams et al. is structurally different from the presently claimed riser reactors. This reference does not teach a reactor or a method for using such a reactor in accordance with the present claims. The combination of Kmecak et al. and Williams et al. does not teach all of the elements of the claims, as required for an obviousness rejection. The combination of these references does not teach a riser reactor comprising a prelift zone, a first reaction zone, and a second reaction zone, wherein the diameter of the second reaction zone to the diameter of the first reaction zone is about 1.5:1 to about 5:1. Thus, the combination of references does not render the claims obvious. The Examiner states that the precise dimensions of the respective zones of the riser reactor would have been considered a result effective variable by a person of ordinary skill in the art, in view of Williams. However, since, as discussed above, Williams does not teach a reactor with the same configuration or reaction zones as the presently claimed invention, this reference would not

have provided motivation to vary the diameters of the reaction zones in a device configured as in the instant invention.

In the Advisory Action dated August 3, 2005, the Examiner states that "the Williams et al. reference was merely provided to illustrate that it is well known in the art to vary the length and diameter of the various sections of riser reactors in order to maintain a desired reaction time within a particular section of a riser reactor" and that "[t]he structural features of the riser reactor in Williams et al. were not meant to bodily incorporated into the riser reactor of the Kmecak et al. reference." The Examiner states that "[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art."

Applicants disagree with the Examiner's characterization of the standard for obviousness under 35 U.S.C. §103. A *prima facie* case of obviousness requires, *inter alia*, that a prior art reference (or references when combined) must teach or suggest all the limitations of a claimed invention. *In re Royka*, 490 F.2d 981 (CCPA 1974); MPEP §2143.01. Thus, the Examiner's statement that the test for obviousness does not require that the claimed invention be "expressly suggested in any one or all of the references" is incorrect. The test for obviousness specifically requires that a cited combination of references teach or suggest every element of a claimed invention. As discussed above, neither Kmecak et al. nor Williams et al., either singly or in combination, teaches teach a riser reactor comprising a prelift zone, a first reaction zone, and a second reaction zone, wherein the diameter of the second reaction zone to the diameter of the first reaction zone is about 1.5:1 to about 5:1. The Examiner stated in the Office Action that Kmecak et al. do not teach the claimed ratios between reaction zones, and there is no teaching in Williams et al. of the claimed reaction zones or ratios between these zones. Since this combination of references does not teach all of these elements, the combination of references does not render the present claims obvious. Applicants respectfully disagree with the Examiner's statement that "[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference." A combination of references together must teach or suggest

all of the elements of the claimed invention. Thus, if references are to be combined, the features that are lacking in one reference (*e.g.*, claimed ratios of reaction zone diameters) must be taught in the other reference, and the combination must teach all of the elements of the entire claimed device, for the combination to support an obviousness rejection. MPEP §2143.03.

Applicants respectfully submit that the Examiner's statement that "the test [for obviousness] is what the combined teachings of the references would have suggested to those of ordinary skill in the art" is also incorrect. Applicants note that the mere fact that references may be combined or modified is not sufficient to render a claimed invention obvious unless the art also suggests the desirability of the combination. *In re Deminski*, 796 F.2d 436 (Fed. Cir. 1986) (holding that there must be a suggestion in prior art references, either singly or in combination, to suggest the desirability and thus the obviousness of a claimed invention); MPEP §2143.01. In the Office Action, the Examiner relies on a statement by Williams et al. that the length and diameter of the various sections of the reactor taught therein are proportioned to maintain a desired reaction time in each section. As discussed above, the reactor taught in Williams is structurally different than that of the presently claimed riser reactors. There is no suggestion in Williams et al. to modify a structurally and functionally different reactor, such as that taught by Kmecak et al., to arrive at the presently claimed riser reactor. A statement that modifications of the prior art are within the ordinary skill in the art (*i.e.*, the Examiner's statement in the Office Action that "one having ordinary skill in the art would have routinely optimized the length and diameter of the various zones of the riser reactor in the apparatus and process of Kmecak et al. in order to obtain the desired reaction conditions within each zone") is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references. *In re Kotzab*, 217 F.3d 1365 (Fed. Cir. 2000); *In re Lee*, 277 F.3d 1338 (Fed. Cir. 2002); MPEP § 2143.01. The Examiner has not provided an objective reason, either within these two references themselves or within the general knowledge in the art, to combine the references.

A *prima facie* case for obviousness also requires a reasonable expectation of success. *In re Rinehart*, 531 F.2d 1048 (CCPA 1976); MPEP §2143.02. The Examiner has not provided evidence that a person of skill in the art would have had a reasonable expectation that modification of the length and diameter of the reaction zones of the reactor taught in Kmecak et al., would have been

successful in producing a riser reactor with the characteristics and advantages of the presently claimed invention (see page 8, lines 14-27 of the specification), where the suggestion that lengths and diameters of sections of a reactor may be varied was provided in a reference that teaches a functionally and structurally different reactor design.

In summary, neither Kmecak et al. nor Williams et al., either singly or in combination, teach or suggest all of the elements of the claimed invention, neither Kmecak et al. nor Williams et al. provide a motivation to combine the teachings therein, and the Examiner has not provided evidence of a reasonable expectation of success in arriving at the claimed invention by combining these two references. Therefore, a *prima facie* case of obviousness has not been established and the cited references do not render the claimed invention obvious under 35 U.S.C. §103(a).

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §103(a).

Claims 8, 16, 24, 32, and 40 are rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Kmecak et al. in view of Williams et al. as applied to claims 1, 9, 17, 25, and 33 above, and further in view of Watts (U.S. Patent No. 2,377, 647). Applicants respectfully traverse this rejection.

The Examiner states that Kmecak et al. are silent regarding a riser reactor configured with an outlet zone and a second junction section located between the second reaction zone and the outlet zone, wherein the second junction section has a circular truncated cone shape. The Examiner further states that Watts teaches a riser reactor comprising an outlet zone and a conjunct section located between the outlet zone and a reaction zone, wherein the outlet zone has a circular truncated shape. The Examiner states that although the collective teachings of Kmecak, Williams and Watts are silent as to the recited vertex angle, it would have been obvious for a person of ordinary skill to select an appropriate vertex angle on the basis of suitability for the intended use.

As discussed above, the combination of Kmecak et al. and Williams et al. does not provide all of the elements of the claimed invention. Therefore, these references are deficient as the basis for an obviousness rejection.

Further, Applicants note that the reactor disclosed by Watts contains only one reaction zone (*i.e.*, reactor 11) and is thus structurally different from the riser reactor as claimed in the present application. As the Examiner admits, Watts does not teach the recited vertex angle. Thus, the combination of Kmecek, Williams, and Watts does not teach all of the elements of the rejected claims as required for an obviousness rejection.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §103(a).

Claims 52, 53, and 58 are rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Kmecak et al. in view of Williams as applied to claim 1 above, and further in view of Carr et al. (U.S. Patent No. 3,639,228).

The Examiner states that Kmecak et al. are silent regarding quench medium comprising regenerated catalyst, but that Carr teaches introduction of catalyst at various locations downstream from the inlet of a reactor, and thus it would have been obvious for one of ordinary skill in the art to provide a quenching medium comprising catalyst to the riser reactor of Kmecak on the basis of suitability of intended use.

As discussed above, the combination of Kmecak et al. and Williams et al. does not provide all of the elements of the claimed invention. Therefore, the combination of these references is not anticipatory and cannot serve as the basis for an obviousness rejection. Carr et al. do not cure the defects of Kmecak et al. and Williams et al. Carr et al. teach a method whereby regenerated catalyst is fed into a reactor at different locations. The reactor taught by Carr et al. is structurally different than the presently claimed reactor. Since Carr et al. do not teach the combination of claimed structural features and ratios of diameters of the reaction zones, the combination of Kmecak et al.,

Williams et al, and Carr et al. does not teach all of the elements of the claimed invention, and this combination of references does not render the claimed invention obvious.

In view of the foregoing, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. §103(a).

CONCLUSION

Applicants have, by way of the amendments and remarks presented herein, removed the issues for the rejections and addressed all issues that were raised in the outstanding Office Action. Accordingly, reconsideration and allowance of the pending claims are respectfully requested. If it is determined that a telephone conference would expedite the prosecution of this application, the Examiner is invited to telephone the undersigned at the number given below.

In the event the U.S. Patent and Trademark Office determines that an extension and/or other relief is required, Applicants petition for any required relief including extensions of time and authorize the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to Deposit Account No. 03-1952 referencing docket no. 456962000200. However, the Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

Dated: November 14, 2005

Respectfully submitted,

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...flow to the fast bed condition. For want of a better term, Avidan and Yerushalmi (1982) termed that range the "dense-conveying" region.

Figure 7.19 presents fluidization data for FCC obtained in the 15·2-cm column mostly over the fast bed range. The figure gives the pressure gradient measured across the middle section of the column as a function of the solid rate at different gas velocities. Over this range, wall–solid friction is relatively small (Van Swaaij *et al.*, 1970; Turner, 1978), and the pressure gradient can essentially be regarded as the fluidized density $\bar{\rho}$ in the section of the bed in question. Figure 7.20 attests to the high solid concentrations that can be maintained in the fast bed at gas velocities that are an order of magnitude greater than those normally employed in a bubbling fluidized bed of the same solid.

The fluidized density is not uniform along the height of the fast fluidized bed. The density is higher at the bottom and decays towards the top. In beds of light powders the density profile may decay very gradually or could even be uniform throughout the upper portions of the vessel. In beds of heavier or coarser solids the decay could be rather sharp. Figure 21 illustrates that even for a fine solid such as HFZ-20, the greater particle density relative to FCC

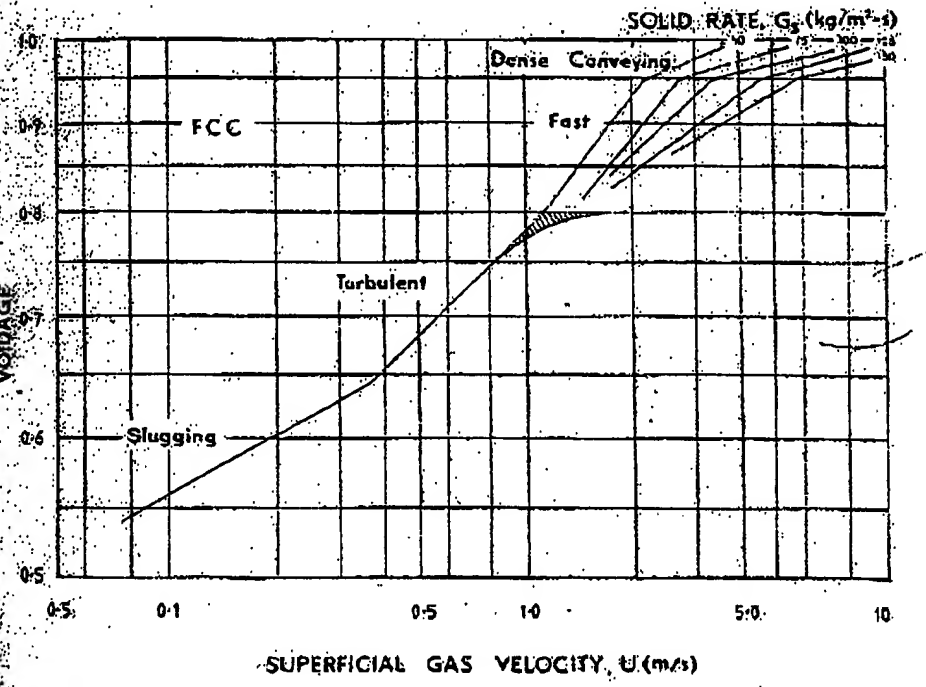

Fig. 7.19. Expansion curve for FCC (from Avidan and Yerushalmi, 1982).

Book name: Fluidization
Editor: J. F. Davidson, R. Clift, D. Harrison
Publisher: Academic Press
Orlando, Florida
Year: 1985
Page: 257

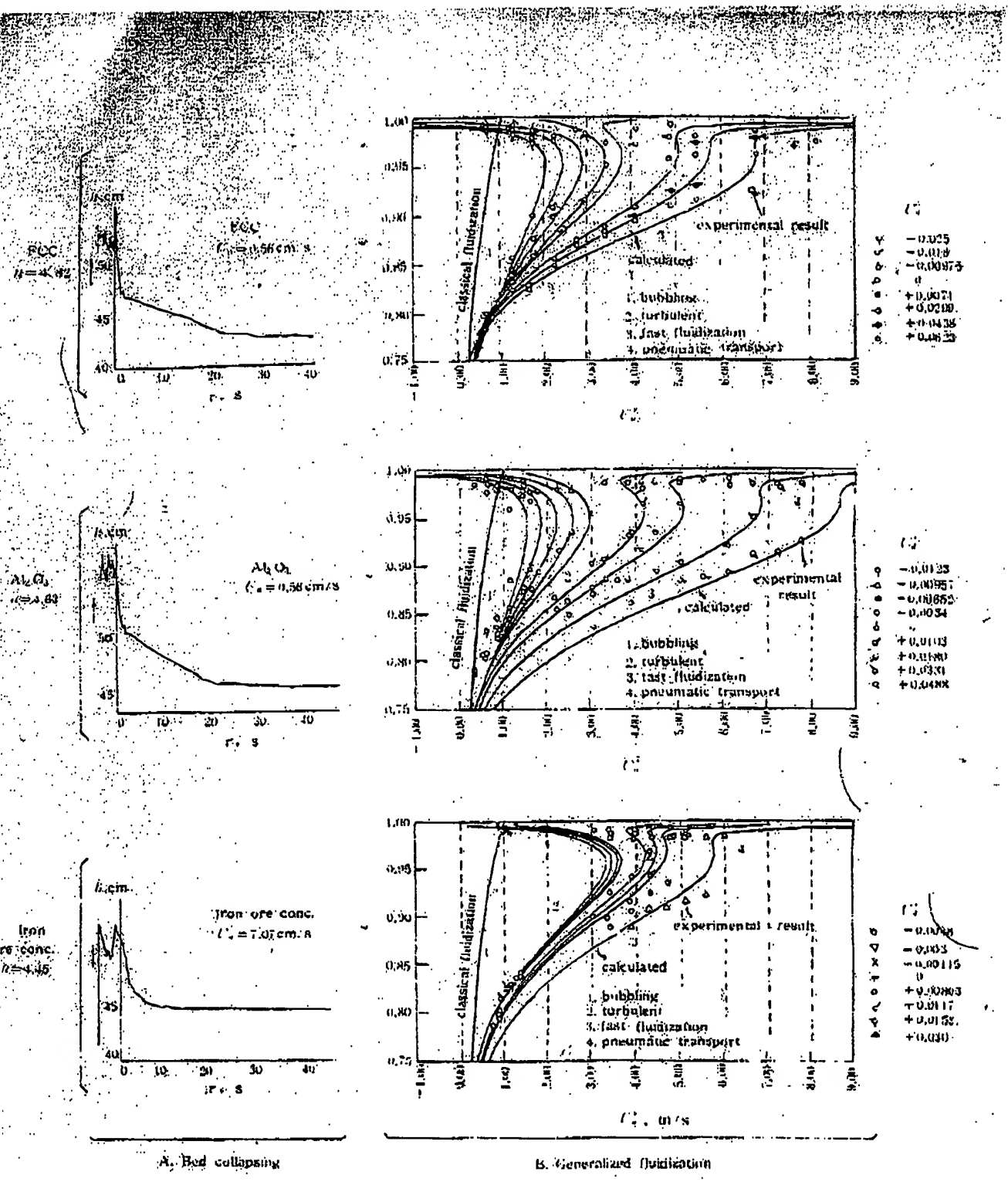

Figure 10-10 Charting G/S Generalized Fluidization against Experimental Data (Chen and Kwauk, 1985)

Book name: Fluidization idealized and bubbleless with applications
Editor: M. Kwauk 地点: Beijing 页: 175
Publisher: Science Press 年: 1992